

CLAIMS

What is claimed is:

1. A drum washing machine, comprising: a water tub, a rotary tub rotatably installed in the water tub, and a clothes-drying unit to dry clothes contained in the rotary tub, wherein the clothes-drying unit comprises:

an air duct to form a closed air circulation system in cooperation with the water tub so as to circulate air through the closed air circulation system;

a blower fan, a heater, and a condensing nozzle installed in the air duct; and

a heat pipe to recover heat from air having a high temperature and a high humidity before the air reaches the condensing nozzle, and to combine the recovered heat with air having a low temperature and a dry state after the air having a high temperature and a high humidity passes through the condensing nozzle.

2. The drum washing machine according to claim 1, wherein the air duct comprises:

a first duct part arranged at a rear end of the water tub, such that the first duct part communicates with an interior of the water tub at a bottom of the rear end of the water tub, and extends upward from the bottom to a top of the rear end of the water tub along an edge of the rear end of the water tub; and

a second duct part extending from the rear end to a front end of the water tub, such that the second duct part communicates at a rear end of the water tub with the first duct part, and communicates at a front end of the water tub with the interior of the water tub.

3. The drum washing machine according to claim 2, wherein the condensing nozzle is installed in the first duct part, and both the blower fan and the heater are installed in the second duct part.

4. The drum washing machine according to claim 3, wherein the heat pipe extends upward from the bottom to the top of the rear end of the water tub so as to be opposite to the first duct part, with a lower end of the heat pipe being arranged in a lower end of the first duct part, and an upper end of the heat pipe being arranged in an upper end of the first duct part, so that the heat pipe recovers the heat from the air having the high temperature and the high humidity which flows in the lower end of the first duct part, and transfers the recovered heat to

the upper end of the first duct part and combines the recovered heat with the air having the low temperature and the dry state which flows in the upper end of the first duct part.

5. The drum washing machine according to claim 4, wherein the heat pipe is covered with a thermal insulation material at an intermediate part thereof, thus transferring the recovered heat from the lower end to the upper end thereof, without significant heat loss.

6. The drum washing machine according to claim 4, wherein the upper and lower ends of the heat pipe are each provided with a plurality of heat transfer fins which are spaced apart from each other at regular intervals, thus recovering and transferring the heat relative to the air flowing around the upper and lower ends of the heat pipe.

7. The drum washing machine according to claim 6, wherein the heat pipe and the heat transfer fins are made of aluminum.

8. A drum washing machine, comprising:
a water tub;
a rotary tub rotatably installed in the water tub; and
a clothes-drying unit to dry clothes contained in the rotary tub, wherein the clothes-drying unit comprises:

an air duct forming a closed air circulation system with the water tub so as to circulate air through the closed air circulation system,
a blower fan,
a heater,
a nozzle installed in the air duct, and
at least one heat pipe recovering heat at a lower end of the air duct from air having high temperature and high humidity and transferring the heat to an upper end of the air duct and combining the heat with air having a low temperature and a dry state.

9. The drum washing machine according to claim 8, wherein the air duct comprises:

a first duct part arranged at a rear end of the water tub, such that the first duct part communicates with an interior of the water tub at a bottom of the rear end of the water tub, and extends upward from the bottom to a top of the rear end of the water tub along an edge of the rear end of the water tub; and

a second duct part extending from the rear end to a front end of the water tub, such that the second duct part communicates at a rear end thereof with the first duct part, and communicates at a front end thereof with the interior of the water tub.

10. The drum washing machine according to claim 9, wherein the nozzle is installed in the first duct part, and both the blower fan and the heater are installed in the second duct part.

11. The drum washing machine according to claim 8, wherein the heat pipe is covered with a thermal insulation material at an intermediate part thereof, thus conducting the recovered heat from the lower end to the upper end of the air duct, without significant heat loss.

12. The drum washing machine according to claim 8, wherein upper and lower ends of the heat pipe are each provided with a plurality of heat transfer fins spaced apart from each other at regular intervals, recovering and transferring the heat flowing around the upper and lower ends of the heat pipe.

13. The drum washing machine according to claim 12, wherein the heat pipe and the heat transfer fins are made of aluminum.

14. The drum washing machine according to claim 8, wherein the blower fan and the heater are installed in the second duct part.

15. The drum washing machine according to claim 14, wherein the blower fan is rotated by a fan motor circulating air in the closed air circulation system.

16. The drum washing machine according to claim 8, wherein dry air flowing from an upper end of the first duct part, is heated by the heater in the second duct part, prior to being introduced into an interior of the rotary tub.

17. The drum washing machine according to claim 9, wherein the at least one heat pipe is arranged at a rear end of the water tub inserted at a lower end of the first duct part and at an upper end of the first duct part.

18. The drum washing machine according to claim 9, wherein an intermediate part of the at least one heat pipe extends along a second half part of an edge of a rear end of the water tub, curved in a direction opposite to a curved direction of the first duct part.

19. A drying-mode method of a drum washing machine, the method comprising:
circulating high temperature dry air through a rotary tub producing high temperature humid air;

recovering heat from the high temperature humid air through at least one heat pipe;
combining the recovered heat with low temperature dry air flowing from the rotary tub;
reheating the combined air producing high temperature dry air; and
re-circulating the high temperature dry air through the rotary tub.

20. A drum washing machine, comprising:
a clothes-drying unit including a plurality of pipes, wherein the pipes recover, during a drying-mode operation of the drum washing machine, heat from high temperature humid air after the high temperature humid air comes out of a water tub, and combine the recovered heat with low temperature dry air flowing from an area around a condensing nozzle.